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# REPORT OF ACCELERATION TEST

ON

PAN SUBSYSTEM, UNIT NO. 2

Project 9040

JANUARY 15, 1963

SPECIAL HANDLING

Prepared by:

Q. A.

Approved by:



25X1

## ABSTRACT

The Pan Subsystem was subjected to acceleration as specified in QTP 49992. It was concluded that the subsystem has sufficent structural integrity in its optical, electrical, mechanical and structural systems to withstand accelerations of actual use and subsequently meets all performance specifications.

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## ADMINISTRATIVE DATA

**Purpose of Test:**

The acceleration test was conducted to determine whether or not the Pan Subsystem had sufficient structural integrity in its optical, electrical, mechanical and structural systems to withstand accelerations of actual use and demonstrate the subsystems ability to meet all performance specifications.

| | |
|---|---|
| **Manufacturer:** | Itek |
| **Serial No.:** | 9040-2 |
| **Quanity of Items Tested:** | 1 |
| **Date Test Completed:** | 15 January 1963 |
| **Test Conducted by:** | [redacted] 25X1 |
| **Disposition of Specimens:** | Use for additional tests. Refurbish as required prior to delivery to customer. |

**Reference Documents:**

| | |
|---|---|
| 43961 | Specification for Pan and S/I Subsystems |
| 49977 | Qualification Test Specification, Pan Subsystem |
| 49992 | Qualification Test Procedure, Pan Subsystem |
| 6117B | Environmental Test Specification |
| J43877 | Electrical Schematic, Overall Equipment |
| J43800 | Assembly Drawing, Main Assembly |

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## FACTUAL DATA

### Description of Test Apparatus:

#### Centrifuge:

Supplied by MIT Instrumentation Laboratory.

#### Test Fixture:

The test fixture, Serial No. 52236, was designed to hold the subsystem at a $2^{o}$ angle as shown in Figure 2. With the unit at this angle, the combined force in the + Z direction is 1.4 g for a force in the - X direction of 10.5 g.

#### Deflection Gages:

The deflection gages consisted of a series of connectors which were used to measure maximum relative motion during acceleration. Deflection gage distribution is shown in Figure 1.

#### Power Supplies:

Three power supplies:

a. Harrison Lab Twin Supply - Mfg. by Harrison Laboratories
b. Regatron - Mfg. by Electronic Measurements Inc.
c. Anders 115V, 400 cps, regulated - Mfg by Anders Electronics.

were used to supply power to interface connector J101.

### Description of Test Specimen:

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The Pan Subsystem was constructed in accordance with Itek Drawing J43877 and J43800. The subsystem had been previously subjected to a vibration and shock test on 1/9/63. This test was followed by a functional operation test and a photo resolution test performed in accordance with QTP #49982 and 49985 to establish a pre-acceleration test baseline.

It should be noted that the cell, Serial No. 05, had been previously tested by Itek and Wright field personnel, in conjunction with another project, to determine the effects of vibration on photo resolution.

### Test Procedure:

The subsystem, containing a fully loaded spool of film was visually inspected for any existing damages or defects. With the reflector

in the stowed position and the cell stowed and locked, the subsystem was mounted on the test fixture and partially enclosed in sheet metal shrouds. Deflection gages were installed in the subsystem as shown in Figure 1 . The ends of the unit were then covered with fabric shrouds and the subsystem was transported by truck to the MIT Instrumentation Laboratory located in Lincoln, Mass.

The test fixture and subsystem were bolted to the MIT Centrifuge as shown in Figures 2 and 3. Power was applied from portable power supplies through the centrifuge slip rings to interface connector J101. Circuit breakers T1 through T5 were wired through the slip rings to a signal box located in the control room. The fabric shrouds were removed and deflection gages T1 through T5 were adjusted so that 1/4 inch relative motion across them would break the circuit causing a lamp in the signal box to be extinguished. Initial readings were taken on all deflection gages and recorded. The shrouds were strapped in position again.

The centrifuge was rotated to produce the following acceleration levels at the outboard end of the subsystem (STA. 162).

| Run No. | Accel. X Axis | Accel. Z Axis | Minimum Time |
|---|---|---|---|
| 1 | 4.0 ± 5% g's | | 5 sec. |
| 2 | 10.5 ± 5% g's | 1.4 g's | 30 sec. |

The subsystem was subjected to acceleration as a function of time as shown in Figure 4 . During acceleration, circuit breaker lamps were monitored for excessive fixture or subsystem deflections. Current drawn from the power supplies was monitored as an indication of subsystem operation.

Upon completion of Run No. 1, the fixture and external circuit breakers were inspected.

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After Run No. 2, the shrouds were removed. A visual inspection of the subsystem was conducted and final readings of the deflection gages were taken and recorded. The subsystem and test fixture were removed from the centrifuge and returned to the Itek Environmental Lab . The subsystem was removed from the test fixture and installed in the DRT dolly. A functional

and a photo resolution test were performed in accordance with QTP #49982 and 49985.

Test Results:

Acceleration as a function of time for the reflector, cell and platen is shown in Figure 4. None of the signal lamps were extinguished during acceleration and no current was drawn from the power supplies, indicating that there were no excessive deflections and the subsystem remained passive throughout the test. Maximum relative deflections observed are listed in Table 1. Visual inspection of the subsystem indicated no visable damage. The subsystem passed the functional test and the photo resolution test indicated an average resolution of 88.5 lines/mm as opposed to the pre-acceleration reading of 89.6 lines/mm.

Engineering Evaluation:

Due to the acceleration gradient along the centrifuge arm, the Pan Subsystem was subjected to maximum longitudinal accelerations varying from 6.3g at Sta. 52 to 10.1g at Sta. 162. Maximum lateral acceleration varied from 1.25g to 1.40g. Maximum resultant acceleration varied from 6.4g to 10.2g.

It should be noted that the reflector and the cell, which are by far the most critical elements in the Pan Subsystem, were in the high end of the acceleration gradient. Figure 4 shows that the reflector sustained a maximum acceleration of 10.1g longitudinally and 1.4g laterally for a period of 30 seconds. The lens sustained 8.8g longitudinally and 1.35g laterally for 30 seconds.

Comparison of pre and post acceleration photo resolution tests indicated no significant change in resolution, thus the reflector and the cell remained optically sound.

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During the acceleration test the platen experienced a maximum acceleration of 6.7g longitudinally and 1.3g laterally, while the film transport assembly at the center of the supply spool had 6.4g logitudinally and 1.3g laterally. Under these loadings, the spanwise center of the film transport assembly and platen structures deflected a maximum of .003 inches each with respect to their ends. In view of the fact that these items

have been designed for photographic rigidity, and consequently have adequat margin of safety for longitudinal acceleration, it can be assumed that both of these items, as well as their supporting structures can safely withstand 10.5g

Comparison of pre and post acceleration functional tests indicated no significant changes in the operation of electrical and mechanical component

During acceleration there was no change in the power-on input, indicating no electrical shorts as a result of deflections.

The acceleration curves (Figure 4) compare test values with actual accelerations in use. Here it should be noted that the test time exceeded actual time by a factor of four at the high loads.

Therefore, it can be concluded that the Pan Subsystem has sufficient structural integrity in its optical, electrical, mechanical and structural systems to withstand accelerations of actual use and subsequently meet all performance specifications.

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Table 1. Maximum Relative Deflections

| CONNECTOR NO. | LOCATION | MAX. DEFL IN |
|---|---|---|
| $T_1$ | Reflector to Scan Housing | .03 |
| $T_2$ | Reflector to MT Flange | .03 |
| $T_3$ | Test Fixture-Center to Base (Y-) | 0 |
| $T_4$ | Test Fixture-Center to Base (Y+) | .03 |
| $T_5$ | Cell to Platen | 0 to 1/6 |
| $C_1$ | Bridge to Trunnion Fitting (Y-) | .035 |
| $C_2$ | Cell to Trunnion Fitting (Y-) | .015 |
| $C_3$ | Cell to Trunnion Fitting (Y+) | .022 |
| $C_4$ | Bridge to Trunnion Fitting (Y+) | .035 |
| $C_5$ | Platen Center to Inner Tube | .003 |
| $C_6$ | Transport to Inner Tube | .003 |

* Connector $T_5$ was not accessible for accurate measurement.

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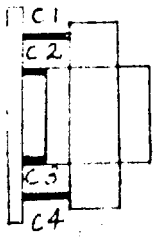
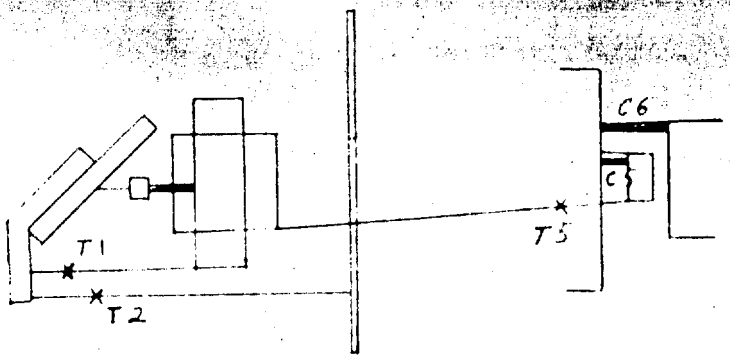



NOTE: T3 and T4 mounted between fixture center and base




$T_1$ to $T_5$ = Connector used to measure relative motion in tension. Used for circuit breaker, set to separate at 1/4 in. defl.

C1 to C6 = Connector used to measure relative motion in compression.

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Figure 1. Deflection Gage Distribution

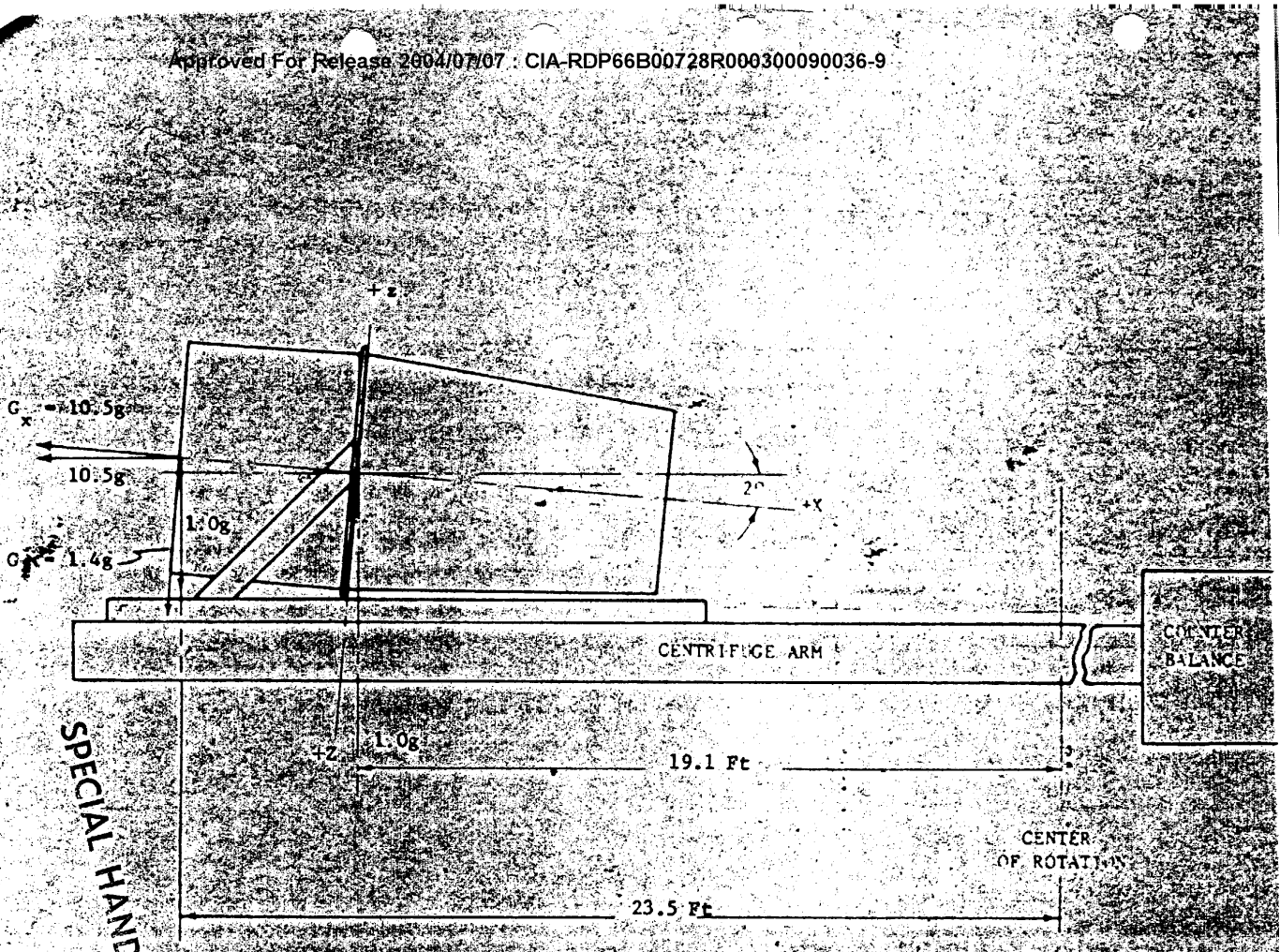


Figure 2. Acceleration Test Set-up;

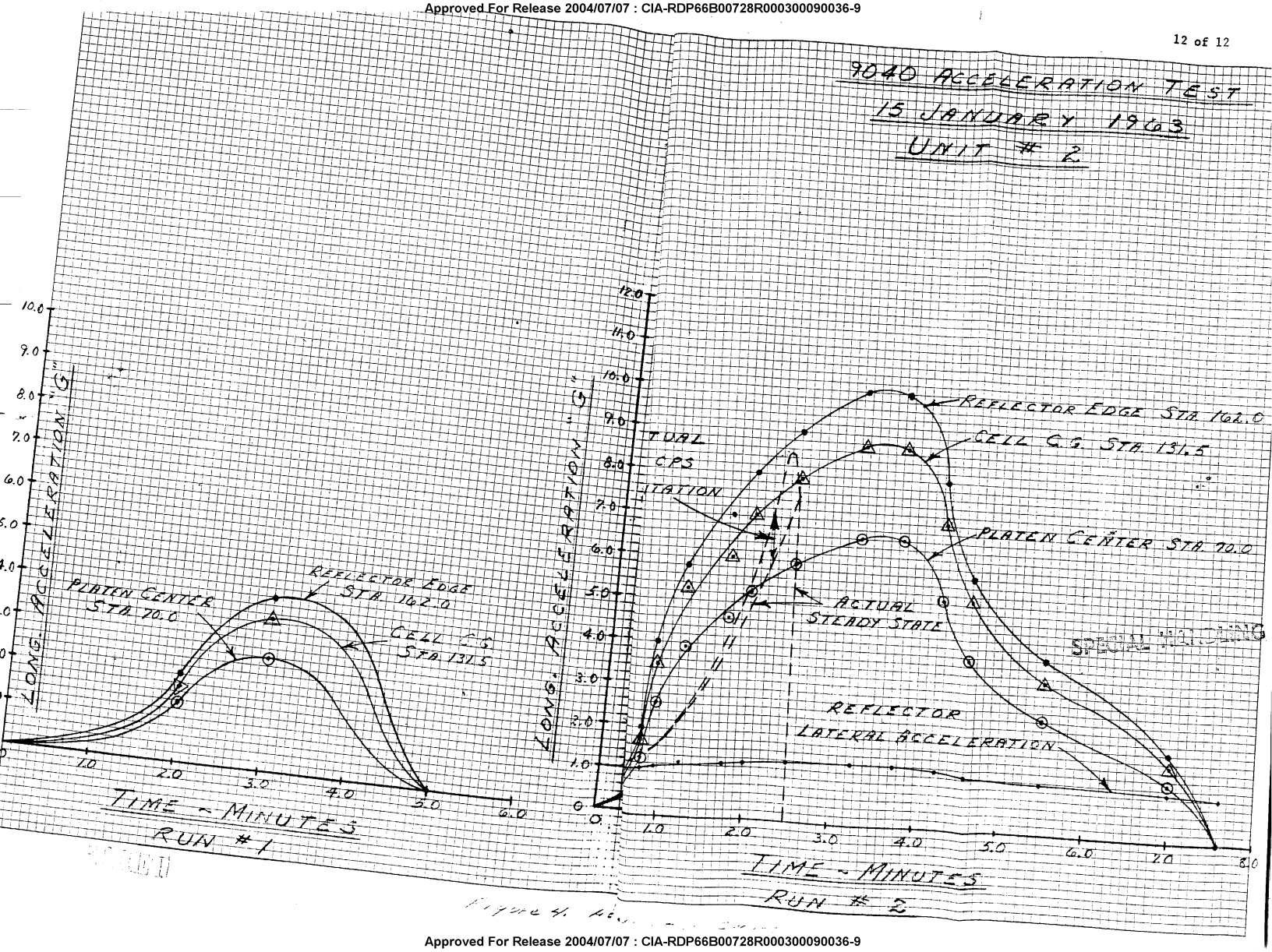


Figure 4. Acceleration Curves